

CLAIMS

I/We claim:

- [c1] 1. An apparatus for launching an airborne device, comprising:
a support;
at least one flexible, elongated member having a first portion coupled to the support at a first attachment site and a second portion coupled at a second attachment site spaced apart from the first attachment site, the at least one flexible, elongated member being tensioned and aligned along a launch path; and
a launch cradle carried by the at least one flexible, elongated member, the launch cradle being movable relative to the at least one flexible, elongated member along the launch path, the launch cradle having a carrier positioned to support the airborne device as the cradle moves along the launch path.
- [c2] 2. The apparatus of claim 1, further comprising the airborne device.
- [c3] 3. The apparatus of claim 1, further comprising the airborne device, and wherein the airborne device includes an unmanned aircraft.
- [c4] 4. The apparatus of claim 1, further comprising:
an energy source; and
a coupling connected between the energy source and the launch cradle to accelerate the launch cradle along the launch path.

- [c5] 5. The apparatus of claim 1, further comprising:
an energy source; and
a flexible towline connected between the energy source and the launch
cradle to accelerate the launch cradle along the launch path.
- [c6] 6. The apparatus of claim 1 wherein the at least one flexible, elongated
member includes at least one of a flexible cable and a flexible rope.
- [c7] 7. The apparatus of claim 1 wherein the support is articulated and
movable between a first position and second position, and wherein the apparatus
further comprises a coupling connected between the support and the launch
cradle to move the launch cradle along the launch path as the support moves
between the first and second positions.
- [c8] 8. The apparatus of claim 1 wherein the airborne device includes an
unmanned aircraft having at least one wing, and wherein the carrier includes a
gripper positioned to releasably grip the at least one wing, the gripper being
automatically changeable from a first configuration to a second configuration as
the cradle decelerates along the launch path, the gripper being engaged with the
at least one wing in the first configuration, the gripper being disengaged from the
at least one wing to release the aircraft when in the second configuration.
- [c9] 9. The apparatus of claim 1 wherein the airborne device includes an
unmanned aircraft having at least one wing, and wherein the carrier includes a
gripper positioned to releasably grip the at least one wing, the gripper having a
first arm and a second arm pivotably coupled to the first arm, the gripper further
having a weight operatively coupled to one of the arms, the weight being
positioned to swing the one arm away from the other when the cradle decelerates.
- [c10] 10. The apparatus of claim 1 wherein the support includes at least one
of a tower, boom and derrick.

- [c11] 11. The apparatus of claim 1 wherein the at least one flexible, elongated member includes a first flexible, elongated member and a second flexible, elongated member, and wherein the cradle contacts and is carried by both the first and second flexible, elongated members.
- [c12] 12. The apparatus of claim 1 wherein the carrier includes two outwardly extending arms, each having a gripping portion positioned to releasably grip wing upper and lower surfaces of the airborne device.
- [c13] 13. An apparatus for launching an unmanned aircraft, comprising:
a support having a first portion and a second portion pivotably coupled to the first portion, the second portion being movable relative to the first portion between a first position and a second position;
at least one flexible, elongated member having a first portion coupled to the support at a first attachment site and a second portion coupled at a second attachment site spaced apart from the first attachment site, the at least one flexible, elongated member being tensioned and aligned along a launch path;
a launch cradle carried by the at least one flexible, elongated member, the launch cradle being movable relative to the at least one elongated member along the launch path, the launch cradle having a carrier positioned to support the unmanned aircraft as the cradle moves along the launch path, the carrier including a first pair of grippers positioned to contact a first wing of the aircraft and a second pair of grippers positioned to contact a second wing of the aircraft, each pair of grippers being automatically movable between an engaged position and a disengaged position as the cradle decelerates along the launch path; and
a coupling connected between the second portion of the support and the cradle to accelerate the cradle along the launch path as the second

portion of the support moves from the first position to the second position.

[c14] 14. The apparatus of claim 1 wherein the coupling includes a flexible towline.

[c15] 15. The apparatus of claim 1, further comprising the unmanned aircraft.

[c16] 16. The apparatus of claim 1 wherein the grippers includes flexible, resilient surfaces positioned to contact the wings of the unmanned aircraft.

[c17] 17. The apparatus of claim 1 wherein at least a part of the second portion of the support structure is flexible and resilient to absorb energy as the cradle decelerates.

[c18] 18. The apparatus of claim 1 wherein each pair of grippers includes a first arm and a second arm pivotably coupled to the first arm, each pair of grippers further having a weight operatively coupled to one of the arms, the weight being positioned to swing the one arm away from the other when the cradle decelerates.

[c19] 19. An apparatus for launching an airborne device, comprising:
support means;
flexible, elongated guide means for guiding the airborne device during launch, the flexible elongated guide means being coupled to the support means; and
carrier means for releasably carrying the airborne device during launch, the carrier means being in contact with the flexible, elongated guide means and movable relative to the flexible, elongated guide means along the launch path.

- [c20] 20. The apparatus of claim 19 wherein the airborne device includes an unmanned aircraft having wings and wherein the carrier means includes gripping means for releasably gripping the wings of the unmanned aircraft.
- [c21] 21. The apparatus of claim 19, further comprising an energy source operatively coupled to the carrier means to accelerate the carrier means along the flexible, elongated guide means.
- [c22] 22. The apparatus of claim 19 wherein the flexible, elongated guide means includes at least one of a cable and a rope.
- [c23] 23. The apparatus of claim 19 wherein the flexible, elongated guide means includes at least two cables.
- [c24] 24. The apparatus of claim 19 wherein the flexible, elongated guide means includes at least two ropes.
- [c25] 25. A method for launching an airborne device, comprising:
releasably carrying the airborne device with a cradle prior to launch;
accelerating the cradle along at least one flexible, elongated member aligned with a launch path;
decelerating the cradle; and
releasing the airborne device from the cradle for flight.
- [c26] 26. The method of claim 25, further comprising:
deploying the at least one flexible, elongated member at an inclined angle;
tensioning the at least one flexible, elongated member;
suspending the cradle from the at least one flexible, elongated member;
and

after releasing the airborne device, releasing tension in the at least one flexible, elongated member and stowing the at least one flexible, elongated member.

[c27] 27. The method of claim 25 wherein releasing the airborne device for flight includes releasing an unmanned aircraft for flight.

[c28] 28. The method of claim 25 wherein releasably carrying the airborne device includes gripping at least a portion of the airborne device with a gripper, and wherein releasing the airborne device for flight includes automatically disengaging the gripper from the aircraft as the cradle decelerates.

[c29] 29. The method of claim 25 wherein releasably carrying the airborne device includes gripping at least a portion of the airborne object with a gripper having a first arm pivotably attached to a second arm and a weight operatively coupled to the first arm, and wherein releasing the airborne object for flight includes automatically disengaging the gripper from the aircraft as the cradle decelerates by allowing the weight to swing forward to pivot the first arm away from the second arm.

[c30] 30. The method of claim 25 wherein releasably carrying the airborne device includes releasably gripping a wing of an unmanned aircraft.

[c31] 31. The method of claim 25 wherein the at least one elongated member depends from an articulated support structure having a first portion and a second portion, the second portion being coupled to the cradle, and wherein accelerating the cradle includes pivoting the second portion of the support structure relative to the first portion.

[c32] 32. The method of claim 25 wherein decelerating the cradle includes absorbing kinetic energy of the cradle with a flexible support.

[c33] 33. A method for launching an unmanned aircraft, comprising:
suspending a flexible, elongated member from a support structure having a first portion and a second portion pivotably coupled to the first portion;
suspending a cradle from the flexible, elongated member;
tensioning the at least one flexible, elongated member;
coupling a towline between the cradle and the second portion of the support structure;
releasably carrying the unmanned aircraft on the cradle by releasably engaging wings of the unmanned aircraft with grippers carried by the cradle;
accelerating the cradle along the at least one flexible, elongated member by pivoting the second portion of the support structure relative to the first portion;
releasing the grippers from the unmanned aircraft by rapidly decelerating the cradle;
releasing the unmanned aircraft from the cradle for flight; and
after releasing the unmanned aircraft, releasing tension in the at least one flexible elongated member and stowing the at least one flexible elongated member.

[c34] 34. The method of claim 33 wherein releasably engaging the wings of the unmanned aircraft includes releasably engaging the wings with a flexible, resilient material.

[c35] 35. The method of claim 33 wherein decelerating the cradle includes absorbing kinetic energy of the cradle with a flexible portion of the support structure.